Knowledge and attitudes towards the use of antibiotics in the paediatric age group: a multicenter survey in Italy

Title

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Running head

Use of antibiotics in paediatric age

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ABSTRACT

Background

Misuse of antibiotics is one of the leading causes of antibiotic resistance. Paediatric patients are greatly involved in this issue, as they are those who receive the most prescriptions of these drugs. Therefore, this study aimed to investigate the knowledge about the use of antibiotics, and the attitudes related to the administration of these drugs to children, amongst parents of children in pediatric age.

Methods

In 2014, a multicentre cross sectional study was conducted amongst parents of children aged between 0 and 14 years. A questionnaire composed by 33 items was administered in waiting rooms of outpatient departments. Multivariable logistic regression models were performed to assess the potential predictors of a better knowledge about antibiotics.

Results

A total of 1247 parents took part to the survey. Around 33% of the sample declared that antibiotics are useful for viral infections and 20.6% that antibiotics are useful for every kind of pain and inflammation, being the same of anti-inflammatory agents, and 14% of parents stated to stop giving antibiotics to their children when they start feeling better. Multivariable models demonstrated that males, unemployed and those who have low educational level are less prone to answer correctly to the questions about knowledge on antibiotics.

Conclusions

The present study demonstrated that parents have a lack of knowledge about the correct use of antibiotics, that results in bad habits and wrong attitudes when it comes to give antibiotics to their children. Attention should be focused in particular on most disadvantaged parents.

MAIN DOCUMENT

Introduction

Antibiotic resistance is the resistance of a bacterium to an antibiotic that was originally effective for treatment of infections caused by it.[1] In recent years, this phenomenon has become worldwide a public health issue. According with the data of the 2011 European Commission report on antimicrobial resistance,[2] resistant bacteria infections cause around 25,000 deaths every year within the EU, leading to an increase of healthcare expenditure and to productivity losses. There are many reasons that lead to antibiotic resistance and one of the main cause is the misuse of antibiotics, in terms of self-prescription, incomplete therapies, missing doses, and re-use of leftovers antibiotics.[3] Paediatric patients are greatly involved in this issue, given that they are the category of patients that receive the most prescriptions of these drugs.[4] This is understandable, considering that children are more susceptible to some kinds of infections.[5] For example, in the UK, the highest prescription rate in the primary care is in children.[6] Ciofi degli Atti et al. e Nyquist et al. found out that more than 40% of the paediatric patients visited by doctors for respiratory infections receive an antibiotic.[7,8] Moreover, a recent study conducted by Adam et al. demonstrated that *Streptococcus Pneumoniae* and *Escherichia Coli* resistant to the most common antibiotic drugs were more frequently found in children than in adults.[9] In this context, the role of young children's caregivers is crucial, given that they usually are the persons who deal with the administration of antibiotics. Many studies highlighted a general lack of knowledge on the correct use of antibiotics by parents of paediatric age children.[10-19] This could lead to an inappropriate administration of antibiotics to children, given that from 10% to 60% of parents declare to administer antibiotics without medical prescription.[11-13,15,19] Moreover, several studies demonstrated that attitudes of parents could influence the decision of the paediatrician about the prescription of an antibiotic, making the lack of knowledge of the parents about this issue even more dangerous.[14,20]

To date no studies have evaluated knowledge and attitudes on antibiotics among parents of children aged between 0-14 years in Italy. It should be noted that in 2011, this Country had one of the

highest consumption of antibiotics in Europe, preceded only by Greece, Cyprus, France and Luxembourg, with a consequent increased likelihood of inappropriate assumptions.[21] Several studies confirmed this finding, particularly in paediatric subjects.[7,22] Therefore, the present study aimed to investigate the knowledge about the correct use of antibiotics, the frequency of administration of these drugs to their children, the mode of acquisition (with or without prescription, generic or branded) and the awareness about the meaning of antibiotic resistance in a sample of parents in seven Italian cities.

Methods

The sample

A multicenter cross-sectional survey was carried out in seven Italian cities (Cassino, Chieti, Napoli, Palermo, Roma, Torino and Udine) between February and May 2014. Participants were recruited in waiting rooms of outpatient departments, with the exclusion of paediatric departments to avoid selection bias. Only parents of children aged between 0-14 years who were able to read and understand the questionnaire in Italian language were interviewed and therefore included in the study. When both parents were present, only one was asked to participate in this study. The estimated number of parents that had to be interviewed in each city in order to obtain validated data was calculated on the basis of demographic data of the resident population in the age group 0-14 years in the different cities participating in the study,[23] and data of the National Institute of Health in 2009 indicating that 56% of Italian children received during the previous year at least one antibiotic prescription.[24] It was decided to keep a very conservative value to maintain a good margin of safety in the calculation of the sample size. The value of Acceptable Worst was calculated on 46% of prescriptions. The calculation of sample size was performed with the software EpiInfo. Participation was voluntary, anonymous and without compensation. The researchers ensured anonymity of participants and the maintenance of ethical principles. In particular, prior to the administration of the survey, the background and the objectives of the study were explained, and

parents were asked to sign an informed consent form. The study was approved by the Ethics committee of the "Città della Salute e della Scienza" Hospital of the city of Torino.

The questionnaire

The questionnaire was developed after a review of studies on this topic in scientific databases and validated by a pilot study on 20 parents. It was composed by 33 items, grouped in five sections, as follows:

1) Socio-demographic characteristics of the parents interviewed, such as gender, age, place and year of birth and education (nine items);
2) Consumption of antibiotics by their children in the last year (two items);
3) Knowledge about antibiotics and related adverse reactions (nine items);
4) Awareness of antibiotic resistance (five items);
5) Attitudes and behaviours towards antibiotic administration to their children (eight items).

Both a 4-point Likert-scale, whose responses ranged from "Strongly disagree" to "Strongly agree", and dichotomous answers (yes/no) were used.

Statistical analysis

Statistical analyses were carried out using STATA V.13 (Stata Corp, College Station, Texas, USA, 2013). A descriptive analysis of the sample was conducted, considering the distribution of gender, age (as categorical variable), country of birth, number of children, marital status, education and occupation in health-related field. Results were expressed in frequencies and percentages.

The answer given through the 4-point Likert scale (items of Section 3 –*"Knowledge about antibiotics"* and Section 4 – *"Awareness of antibiotic resistance"*) were dichotomized as follows: "totally agree" and "agree" versus "totally disagree" and "disagree", depending on the meaning of the question. For each outcome, the percentages of appropriate answers ("Strongly agree/Agree" or "Strongly disagree/Disagree") were assessed.

Moreover, for each statement in which the Likert scale was used, a score ranged from 1 to 4 was given on the basis of the correctness of the answer (from 1 if totally incorrect to 4 if totally correct). Four overall scores were then elaborated by grouping the statements as follows:

1. First group: *"Identification of antibiotics"*(penicillin is an antibiotic / aspirin is an antibiotic / Paracetamol is an antibiotic);
2. Second group: *"Knowledge about antibiotic role"*(antibiotics are useful for bacterial infections / antibiotics are useful for viral infections / antibiotics are the same as anti-inflammatory agents);
3. Third group: *"Knowledge about side effects of antibiotics"*(antibiotics can cause side effects / antibiotics can cause allergic reactions / antibiotics can cause secondary infections after killing good bacteria present in our organism);
4. Fourth group: *"Knowledge about antibiotic resistance"*(antibiotic resistance is a phenomenon for which a bacterium loses its sensitivity to an antibiotic / misuse of antibiotics can lead to antibiotic resistance / it is possible to stop taking antibiotic when symptoms are improving).

Since each group had three statements, the score ranged from 3 (all the three answers extremely incorrect) to 12 (all the three answers extremely correct). A score was considered as "good" if the total points resulted 10 or more, and "bad" if the total points were from 3 to 9.

About attitudes and practices, eight outcome variables were considered:

- Do you usually give antibiotics to your child/children every time they have a cold or sore throat?
- Do you usually give antibiotics to your child/children every time they have fever?
- Do you usually stop giving antibiotics to your child/children when he/she/they start feeling better?
- Do you give antibiotics to your child/children only when prescribed by the paediatrician?
- Do you usually have leftover antibiotics at home?

- Do you usually use leftovers antibiotics when your child/children has/have cold, sore throat or flu without consulting your doctor?
- Do you usually buy antibiotics for your child/children without medical prescription?
- Do you usually give antibiotics to your child/children only after a phone call with your paediatrician, without a proper medical examination?

For each of these question, the total percentages of "yes" and "no" answers were calculated. Finally, multivariable logistic regression models were performed to assess the potential predictors of a better knowledge about antibiotics. The covariates to be included into the final model were selected using a stepwise forward selection process, with a univariate p value <0.25 as the main criterion.[25] Results are expressed as OR with 95% CI, and a two-tailed p value <0.05 was considered significant for all analyses.

Results

Descriptive analysis

A total of 1,247 parents (mothers or fathers) were interviewed. Females were 70.1% and the main age was 40.9 years (SD ±7.5). The majority of the interviewed people were Italian (93.9%). Half of the sample declared to have more than one child, with a mean of 1.6 children for each parent (SD ±0.7) Moreover,88% of the interviewed persons stated to be married or to live with a partner. Around18% of the sample had an occupation in the healthcare field. Almost 70% of the sample declared they had given antibiotics to their child/children at least one time in the previous year.(Table 1)

Knowledge about antibiotics

The answers to the 12 statements related to knowledge about identification, role and side effects of antibiotics and antibiotic resistance are presented in Table 2, together with the score obtained for each group of statements. About the identification of antibiotics, a "bad" score was totalized by

more than 10% of the respondents, while a bad score on the group of items on the role of antibiotics was realized by 42% of the parents interviewed. In particular, 32.8% of the sample declared that antibiotics are useful for viral infections and 20.6% that antibiotics are useful for every kind of pain and inflammation, being the same of anti-inflammatory agents. Furthermore, a bad score on "side effects of antibiotics" was totalized by 20.9% of the sample. In particular, 18% of the parents disagreed with the fact that antibiotics can kill good bacteria present in our organism. Regarding antibiotic resistance, 13.7% of the sample did not agree with the statement "Antibiotic resistance is a phenomenon for which a bacterium loses its sensitivity to an antibiotic", and 14.9%declared that it is possible to stop taking antibiotics when symptoms decrease. An overall bad score about this group of statements was achieved by 26.7% of the parents.(Table 2)

Attitudes about antibiotics

Results about parents' attitudes on antibiotic administration to their children are described in Table 3. Interestingly, 14% of the sample stated to stop giving antibiotics to their children when they start feeling better, despite advises of paediatricians to do a complete cycle of these drugs. Moreover, 17% declared to give antibiotics to their children without the prescription of the paediatrician and 25.9% to buy antimicrobial drugs without medical prescription. Furthermore, the majority of the parents interviewed (55%) used to give antibiotics to their children after a simple call to the paediatrician, without a proper medical examination. (Table 3)

Multivariable analysis on knowledge about antibiotics

In Table 4 are described the likelihoods of obtaining a "good" score in the four groups of items related to knowledge on antibiotics and antibiotic resistance. After adjusting for confounding factors, females resulted to have a greater likelihood of obtaining a good score in all the four outcome variables, if compared with males. In particular, females have more probability to totalize a good score about identification of antibiotics if compared to males (OR 4.15, [CI 95% 2.61,

6.61]). Moreover, for three out of four outcomes considered (identification of antibiotics, knowledge about antibiotic role and knowledge about antibiotic resistance), parents with a low educational level (less than high school) have statistically significant less chance to obtain a good score than parents with at least a college diploma, with OR 0.27 [95% CI 0.15, 0.50], 0.26 [95% CI 0.18, 0.38] and 0.26 [95% CI 0.17, 0.41] respectively. Besides, unemployed parents and students have a lower likelihood of getting a good score, in all the four outcomes considered, if compared with employed parents. In this case, odds ratios ranged from 0.62 [95% CI 0.45, 0.84] for the variable *"Knowledge about antibiotic role"* to 0.32 [95% CI 0.20, 0.52] for the variable *"Identification of antibiotics"*. As expected, working in a health related field seemed to improve the chances to obtain a good score. In particular, those who work in a health related field have 2.03 times more probability to get a good score [95% CI 1.36, 3.04] on the knowledge about antibiotic role, 2.77 times [95% CI 1.53, 5.03] on the knowledge about side-effects and 2.14 times [95% CI 1.27, 3.60] on the knowledge about antibiotic resistance than people that stated not to work in health-care related field.

Comments

This multicenter study aimed to investigate knowledge, attitudes and practices about antibiotics in a sample of parents (or legal protectors) in seven Italian cities. To our knowledge, this is the first study investigating this issue in Italian context. Previous Italian studies on this topic indeed were focused on general population,[26] or medical students.[27] The results of our study showed how interviewed parents have a fair good knowledge on identification of antibiotics, given that only 4% stated that aspirin is an antibiotic and 7% that antibiotics are the same as anti-inflammatory agents. However, despite these promising results, a general lack of knowledge was assessed on the role of antibiotics in the treatment of infectious diseases, the potential side effects of these drugs and the issue of antibiotic resistance. Indeed, the scores obtained combining the answers of homogeneous group of statements were "bad" in a percentage between 10% and 40%. Moreover, many of the

respondents demonstrated to have a low level of knowledge about antibiotics, in terms of usefulness for viral infections and for every kind of pain and inflammation, and about side effects such as the destruction of the bacterial flora present in our organism. Percentages similar to those of our study were instead found in a survey conducted among parents of children < 5 years old. In this case, 40% of the sample was not aware that antibiotics are useful only for bacterial infection.[28] In a previous study on this topic conducted in Cyprus among parents of children between 4 and 7 years of age, 93% of the sample acknowledged that antibiotics have side effects and 87% that fever is not an indication for the administration of antibiotics.[14] In the general population, a recent meta-analysis of 24 observational studies showed how 50% of the sample stated that antibiotics are useful for cold and flu and 54% that antibiotics can treat viral infections.[29] A study on this topic in a sample of students of a School of medicine, gave, as expected, more promising results.[27] The multivariable models, carried out in order to identify the possible predictors of high levels of knowledge, showed how dads have a pronounced lower knowledge on the identification, the role and the side effects of antibiotics, and on the issue of antibiotic resistance. Moreover, educational level and employment status seemed to influence the knowledge of caregivers about antibiotics. Indeed, parents with a high school diploma had a higher likelihood of totalize good scores than those with a lower educational level. It is interesting to notice that also those who are unemployed or student had a lower probability to get good scores than those who work. Moreover, as expected, those who work in a health related field had better results than those who do not. These results are similar to those presented in the study conducted in Cyprus, where educational level, gender, income, residency, being an immigrant, having a health insurance and number of children resulted the main socio demographic factors associated with knowledge about antibiotics.[14] Another study, conducted on a sample of more than five thousand Greek parents, reported that gender (in particular, being a father instead than a mother), low income, low education, immigrant status and the number of children (less than two or more than three) were all variables associated with lower knowledge about antibiotics, in particular about upper respiratory tract infections.[16] As results of our multivariable

models the number of children was not significantly correlated with the four knowledge outcome variables considered.

This general lack of knowledge leads to bad attitudes on antibiotic consumption. Almost 15% of the parents declared to stop giving antibiotics to their children when they start feeling better, without completing the cycle of therapy as prescribed by the paediatrician. In addition, it is even more worrying that one out of four of the parents declared to give antibiotics to their children without any medical prescription. These findings are in part similar to those of the study conducted in Greece by Panagakaou et al., that pointed out that 10% of the parents would consider giving their children antibiotics without previous medical advices, and that 44% received antibiotic recommendation from their paediatrician over the phone.[16] These results make clear that there is the need to inform and form caregivers of children in paediatric age about good practices and attitudes in antibiotic usage and many initiatives had been implemented in previous years in this regard.[30-31] It worth a mention e-Bug, a project that aimed to disseminate a school antibiotic and hygiene educational pack and website across Europe. Both this educational program and some correlated initiatives demonstrated that it is possible to improve the level of knowledge of both children and parents about antibiotics and antibiotic resistance.[31] Since the World Health Organization highlights the problem of antibiotic resistance as a major health threat for the coming decade, these issues are very important and an increase in appropriateness for the use of antibiotics is needed.[1] In this regard, scientific literature shows the importance of stewardship programs that can help in decreasing the incorrect use of antimicrobial drugs without decreasing the quality of care provided.[32]

This study had some strengths and limitations that should be acknowledged. One of the main strengths is represented by the sample size (1247) of parents of children between 0-14 years of age interviewed. This sample is higher than other studies on this topic,[11-13,17-19] especially when considering that face-to-face interviews were carried out. Indeed, this is considered the gold standard method of survey administration.[33] Another strength is that interviews were carried out in different cities in the north, centre and south of Italy, giving the opportunity to obtain a

representative sample of the different Italian contexts, even more important when considering that people living in different cities have diverse approaches to many health related issues.[34,35] Differences about knowledge and attitudes on antibiotics and antibiotic resistance among the cities that are included in this study will be assesses in an another paper. A possible limitation of this study is the fact that face-to-face interviews could lead to a selection bias, given that the most introspective persons are less prone to participate in the survey. Moreover, the multicenter nature of this study could lead to variability among interviewers. However, all the persons that administered the questionnaire were trained researchers.

In conclusion, this study demonstrated that parents of children aged between 0 and 14 have a lack of knowledge about the use of antibiotics, that results in bad habits and wrong attitudes when it comes to give antibiotics to their children. Attention should be focused in particular on most disadvantaged parents (those who have low educational level, and/or unemployed), given that they demonstrated a significant lower level of knowledge about antibiotics. There is the need to strengthen the implementation of specific programs aimed at increasing the health literacy of Italian parents on antibiotics consumption and antibiotic resistance.

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Table 1 – Characteristics of the sample (N=1,247)

		Total % (N)
Age (mean)		40.8 (± 7.5)[a]
Age class	*18-40 y*	49.2 (613)
	41-70 y	50.8 (633)
Gender	*Male*	29.9 (371)
	Female	70.1 (871)
Nationality	*Italian*	93.9 (1156)
	Foreign	6.1 (75)
N° of children	*One*	49.9 (609)
	More than one	50.1 (612)
N° of children (mean)		1.6 (± 0.7) [a]
Marital status	*Married/cohabiting*	88 (1096)
	Single or other [b]	12 (149)
Educational level	*College or more*	32.7 (407)
	High school	47.9 (597)
	Less than high school	19.4 (241)
Occupation	*Employed*	70.7 (880)
	Not employed / student	29.3 (365)
Occupation in the health care related	*Yes*	17.9 (212)
field	*No*	82.8 (971)
Use of antibiotics in the last year	*Yes*	69.8 (862)
	No	30.2 (372)

[a] mean ± standard deviation

[b] divorced, separated, widow/widower

Table 2 – Knowledge about antibiotic consumption and resistance (N=1,247)

		Total
		% (N)
Use of antibiotic in the last year	*Yes*	69.8 (862)
	No	30.2 (372)
Penicillin is an antibiotic	*Strongly agree/agree*	93.5 (1153)
	Disagree/strongly disagree	6.5 (80)
Aspirin is an antibiotic	*Strongly agree/agree*	3.8 (47)
	Disagree/strongly disagree	96.2 (1195)
Paracetamol is an antibiotic	*Strongly agree/agree*	6.0 (75)
	Disagree/strongly disagree	94.0 (1168)
Score: identification of antibiotics	*Good*	89.4 (1099)
	Bad	10.6 (131)
Antibiotics are useful for bacterial infections	*Strongly agree/agree*	87.0 (1073)
	Disagree/strongly disagree	13.0 (160)
Antibiotics are useful for viral infections	*Strongly agree/agree*	32.8 (406)
	Disagree/strongly disagree	67.2 (832)
Antibiotics are the same as anti-inflammatory	*Strongly agree/agree*	20.7 (256)
agents	*Disagree/strongly disagree*	79.3 (984)
Score: knowledge about antibiotic role	*Good*	57.2 (700)
	Bad	42.8 (524)
Antibiotics can cause side effects	*Strongly agree/agree*	92.6 (1148)
	Disagree/strongly disagree	7.42 (92)
Antibiotics can cause allergic reactions	*Strongly agree/agree*	94.77 (1178)
	Disagree/strongly disagree	5.23 (65)

Antibiotics can cause secondary infections after killing good bacteria present in our organism	*Strongly agree/agree*	82.0 (1008)
	Disagree/strongly disagree	18.0 (221)
Score: knowledge about side effects of antibiotics	*Good*	79.1 (968)
	Bad	20.9 (255)
Antibiotic resistance is a phenomenon for which a bacterium loses its sensitivity to an antibiotic	*Strongly agree/agree*	86.3 (960)
	Disagree/strongly disagree	13.7 (153)
Misuse of antibiotics can lead to antibiotic resistance	*Strongly agree/agree*	88.1 (1055)
	Disagree/strongly disagree	11.9 (143)
It is possible to stop taking antibiotic when symptoms are improving	*Strongly agree/agree*	14.9 (181)
	Disagree/strongly disagree	85.1 (1030)
Score: knowledge about antibiotic resistance	*Good*	73.3 (809)
	Bad	26.7 (294)

Table 3 – Attitudes and behaviours towards antibiotic administration (N=1,247)

		Total % (N)
Do you usually give antibiotics to your child/children every time they have cold or sore throat?	*Yes*	90.1 (1121)
	No	9.9 (123)
Do you usually give antibiotics to your child/children every time they have fever?	*Yes*	13.3 (165)
	No	86.7 (1076)
Do you usually stop giving antibiotics to your child/children when he/she/they start feeling better?	*Yes*	14.2 (176)
	No	85.8 (1067)
Do you give antibiotics to your child/children only when prescribed by the paediatrician?	*Yes*	82.9 (1026)
	No	17.1 (212)
Do you usually have leftover antibiotics at home?	*Yes*	40.1 (494)
	No	59.9 (739)
Do you usually use leftovers antibiotics when your child/children has/have cold, sore throat or flu without consulting your doctor?	*Yes*	13.2 (163)
	No	86.8 (1075)
Do you usually buy antibiotics for your child/children without medical prescription?	*Yes*	25.9 (320)
	No	74.1 (914)
Do you usually give antibiotics to your child/children only after a phone call with your paediatrician, without a proper medical examination?	*Yes*	55.0 (678)
	No	45.0 (554)

Table 4 – Multivariable results on knowledge about antibiotic consumption and resistance (N = 1,247)

		Identification of antibiotics	**Knowledge about antibiotic role**	**Knowledge about side-effects**	**Knowledge about antibiotic resistance**
Age (Continuous)		1.02 (0.99-1.05)	**1.03 (1.01-1.05)**	**1.02 (1.00-1.04)**	**1.04 (1.02-1.06)**
Gender	Male	Ref	Ref	Ref	Ref
	Female	**4.15 (2.61-6.61)**	**1.77 (1.32-2.36)**	**1.83 (1.30-2.56)**	**1.76 (1.26-2.46)**
Country of birth	Italy	-	Ref	-	-
	Foreign	-	0.63 (0.37-1-07)	-	-
Number of	One	-	-	-	Ref
children	More than one	-	-	-	1.29 (0.96-1.73)
Marital status	Married/Cohabitee	Ref	Ref	-	-
	Single/Widowed	**0.54 (0.32-0.91)**	0.77 (0.52-1.13)	-	-
Educational level	University or more		Ref	Ref	Ref
	High School	0.71 (0.40-1.27)	**0.51 (0.37-0.69)**	0.86 (0.60-1.24)	**0.55 (0.38-0.80)**
	< High school	**0.27 (0.15-0.50)**	**0.26 (0.18-0.38)**	0.88 (0.56-1.38)	**0.26 (0.17-0.41)**
Occupation	Employed	Ref	Ref	Ref	Ref
	Unemployed/student	**0.32 (0.20-0.52)**	**0.62 (0.45-0.84)**	**0.54 (0.38-0.78)**	**0.58 (0.41-0.83)**
Working in a	No	Ref	Ref	Ref	Ref
health related field	Yes	2.10 (0.89-4.93)	**2.03 (1.36-3.04)**	**2.77 (1.53-5.03)**	**2.14 (1.27-3.60)**
Relatives working	No	Ref	Ref	Ref	Ref
in health-related	Yes	1.13 (0.67-1.91)	1.29 (0.95-1.76)	**2.22 (1.47-3.37)**	1.21 (0.84-1.74)
field					
Use of antibiotic in	No	Ref	-	Ref	-
the last year	Yes	1.49 (0.97-2.29)	-	0.73 (0.52-1.03)	-

Results highlighted in bold are statistically significant.